Knowledge Management and Data Mining for Marketing

[1]Rostam Pour Rashidi, [2]Danial Arab Nosratabadi, [3]Hasan Khodayi Jalalabadi

[1,2,3] Department of Public Management, Kerman Branch, Islamic Azad University, Kerman, Iran

ABSTRACT

Because of Multiplicity of the technology and information systems, the business is going to collect more customer data in large databases. However, the most useful insights into the characteristics of customer marketing and purchasing patterns are hidden. The recent emphasis on customer relationship management makes the performance of marketing very ideal application and by applying data mining tools for supporting decisions; it will get so many benefits. The systematic methodology that uses knowledge management and data mining is proposed for retrieve knowledge management and marketing decision. This methodology can be considered essential for enhancing customer relationship management.
KEYWORDS: Customer, Knowledge management, Marketing

INTRODUCTION

Recently the advents of information technology of marketing techniques and managing companies' information about customers have been changed. Being a large volume of data about customers, that is coming by the new tools of information technology, has created challenges and opportunities for trade. Thus the data will be used and the competitive benefit will be obtained. For instance, Wal-Mart, the largest retailer in the US for a customer database, contains about 43 terabytes of data. It is larger than the database which is used by the internal efficiency of investments and the income for tax collection.(1) The internet and web, make the data collection process and collecting information and data on trade much more easier. On one hand, many organizations have been realized that the knowledge contained in this extensive database is an important factor to support multiple organizational decisions. In particular, the customer knowledge of this database is suitable for marketing and performing. However, most of the knowledge and useful information are hidden and intact. On the other hand, the intensity of competition and increasing the consumer choice has created a new pressure on the marketing decision makers. This new phenomenon is called customer relationship management, which has required the organization's products and services tailored made according to customer's actual preferences that interact with them. While the organizations are tending towards customer relationship management, the performance of marketing, as the coastline to interact with customers, is more affected. (10) The detecting is that the effective management of customer relationships can only be based on a correct understanding of the needs and preferences of customers. Under these terms, the data mining tools can help for discovering the hidden knowledge and better understanding the customer, while the Systematic KM efforts can connect knowledge to the marketing strategies. This makes the study of knowledge management, which is important for marketing as well, to be studied.

The progress in database processing, data storage, learning machine and knowledge management helps us to understand the data mining process. Recent researches on knowledge discovery and data mining have increased our perception of the application of data mining and knowledge discovery process. But the most researches have been focused on theoretical and computational discovery process template and a set of applications such as risk prediction or detection of fraud and deception. By specifying the importance role that the marketing decisions have in the environment of customer, a simple and complete framework for the systematic management of customer knowledge is required. However the lack of a simple and comprehensive framework to link the customer knowledge and management and application of knowledge, is considerably felt, especially this case is more in the marketing decisions. (11) While data mining researches are focused on techniques, customer relationship researches will be focused on relationship with customers and strategies for managing the customer interactions. The correct customer relationship management is possible just by completion the process of discovery knowledge management and by using this knowledge for marketing strategy. This will help the businessmen to meet customer needs based on what the marketers know about the clients. Our subject in this paper provides a complementary framework for knowledge management by focusing on marketing decisions. We arrange this paper as follows: first, the classification of work in data mining is represented and knowledge management is discussed as a process with high efficiency. (section 2)

* **Corresponding Author:** Rostam Pour Rashidi, Department of Public Management, Kerman Branch, Islamic Azad University, Kerman, Iran. pourrashidi@iauk.ac.ir

Then the helpful marketing and customer knowledge are reviewed by data mining (section 3). Marketing decisions based on customer knowledge will lead to a knowledge-based marketing (section 4). Finally, our discussion will be closed by determining the issues to study and review completely the marketing knowledge management. (9)

Data mining tasks

Data mining is the search process and analyzing data to find the right information. Which includes selecting, exploring and modeling of data to uncover previously unknown patterns and ultimately gives understandable information from the database. Data mining uses the wide range of computational methods, including statistical analysis, decision trees, neural networks, development and graphic visualization. However data mining tools already exist, but improvements in computer hardware and software, in particular discovery tools such as neural networks and data visualization(imaging) make the it more practical and interesting.

Deriving the model is a major part of any activity in data mining that focuses on the relationships between the data sets. Formally, a pattern is defined such as follows:

Expressing s in l on the relationship between subsets of facts fs and specified sets of facts f, is described with some certainty. So that S is simpler than counting the full facts in fs.

Data mining is used to infer patterns from large data sets. Multiple performance data mining can be divided in to five categories that is summarized in Figure 1. This classification reflects the role of portraying data as a separate data mining function, and even is used for supporting the other data mining function. Various performance of data mining is classified to some groups base on the type of inferred knowledge by these tasks. Determination of the pattern in massive data sets, is the first step to obtain useful and appropriate attitude in marketing and get important decision. The operation of data mining causes the classification of market knowledge and customer that constitute the center of knowledge management process. The main task to be performed is determined by the marketing problem and represents some examples about marketing to express how to use data mining functions.

Figure 1. Classification of Data Mining

Performance of data mining				
Dependency Analysis	Determine the Class	Describe the Concept	Deviation from the Route Discovery	Data Picturing
Sequence of Dependency	Classification of Mathematics	Comparison, Discrimination and Summary	Anomaly Changes	

Dependency Analysis

The primary type of dependency knowledge is the relationship between a set of represented items by a minimum special confidence. This is also called "analysis of the market" and gives us the information about the relationship between different products purchased by the customer. This kind of knowledge can be useful in the development of marketing strategies and the development of products that has dependent relations in the mind of consumers. For example the rules that exist in the history of P(such as "sausage") and therefore Q(such as "mustard"), may be help to specify additional items that must be sold with P(sausage), to this end it will become similar to Q(i.e. mustard) and sold with its.(3)

Determination of class(category)

Determine the class is grouping the customers into categories that have been defined. There are two types of class designations, mathematical classification and categories concept. Mathematical algorithms for classification make some categories or classes that increase the similarities between categories but reduce the internal similarity of each category. For example, a store can classify the customers based on the amount of income or the last amount of their purchasing and then consider its marketing efforts. Return and failure to do this is because of the inability to use the background information, such as domain knowledge, to facilitate classification. The concept of sorting overcome this limitation and the classes will be determined later to attribute the similarity and relationship context to it (as defined by the domain knowledge). The member of knowledge management, classify and complete a field with a set of useful features. For example, based on the log data of internet users, internet companies can categorize the web users into users "only Email", "surfer serious" and "surfer fun".

Description of Data

Data describing is a technique for grouping customers according to domain knowledge and data base(without the mandatory defined groups). Describe the data can be used to summarize, detection, discrimination or compare the client's knowledge and marketing. Summarized data is also a process to adaptation of subset features of the data.

Technically, summarized of the concept of A are performed by scanning all data that estimate A and for all the fields are calculated. By summarizing, the marketer can learn about the customer and group them according their occupation, income, saving patterns and type of purchases and makes autobiographical form for customers. Detection or discrimination describes enough qualities for distinction of records in one class to another class. For example, color of a car may be used to identify that the vendor is from the Midwest or not. This can be done by the detection algorithm. However, this method of comparison describes the class in a way that makes the analysis and comparison with other records facile. For instance, the seller from Midwest may have a blue car and has an average of 100calls per week for sale. This description may act as a baseline against which we can have a separate judgment of the seller. Comparison analysis can be done with statistical or visual (video) techniques.

Fraud Detection

This method is useful for detecting fraud and its variations. Things that are contrary to the rules are far from normal (are different from normal case). For example, comparison between same group of sellers and detecting the ones who are far from the average(with a negative way or positive way). Note that it is necessary to correct the group factors before comparison. The anomaly can be detected by the analyzing standard deviation, mean and data volatility measures. In addition, fraud cases may have variables or characteristics that are significantly different with previous transactions of a customer or group of customers. The credit card of company may increase suddenly in credit purchases(proprietary). This change in behavior can cause the change on the client and it is not necessarily for abuse and fraud. Therefore, alter or affirm will be done, after updating the knowledge.

Picturing Data

Hardware reconfiguration allows that the marketers view the complex patterns in customer data(in terms of the visual objects are completed in three dimensions. They also create advanced capabilities for segmentation, restore or enlarge the issues so that the observed patterns in different levels of detail are provided. Thus, the knowledge discovery in database and visualization in data can work alone or in conjunction with others such as dependency analysis, defining and identifying the category, describing and discovering deviations. Kim had a detailed analysis of visual techniques(for mining large databases) and classified the visual techniques into geometric design, pixel and graph. Pixel oriented techniques display the value of each data into pixel color and represent the data values belonging to each feature in separate plan windows. Geometric design techniques, aimed at finding interesting patterns in multi-dimensional data sets. The main idea of graph-based techniques is to provide a large graph using the algorithm design, ESP and summarization techniques. The examples are graph display, two-dimensional and three-dimensional charts, graphs (Super Charts) and also See Net.(2)

Knowledge Management Process

Learning and knowledge discovery is an iterative process that gathers data mining techniques in knowledge management framework (Figure 2). Although data mining techniques are commonly used in database complete, but the exploration of data samples is (statistically) possible. So the first step of this process is a decision for sampling or completing database. While this decision is made, in the next step we mine the data by using some works such as picturing the data. Because the purpose of this step is getting the first sense of data to choose data mining works and suitable variables. For mining the data sets, the marketer may use one or more data mining techniques such as neural networks, tree methods, methods of justifying and explaining decisions or other statistical methods. For detecting the suitable method for solving the marketing problem and the right prediction of future customer's behavior, a result data mining efforts will be assessed. This evaluation of the data sets, provides the greater insight and helps the marketers to improve data mining models and its appeal.

Figure 2. Knowledge management process
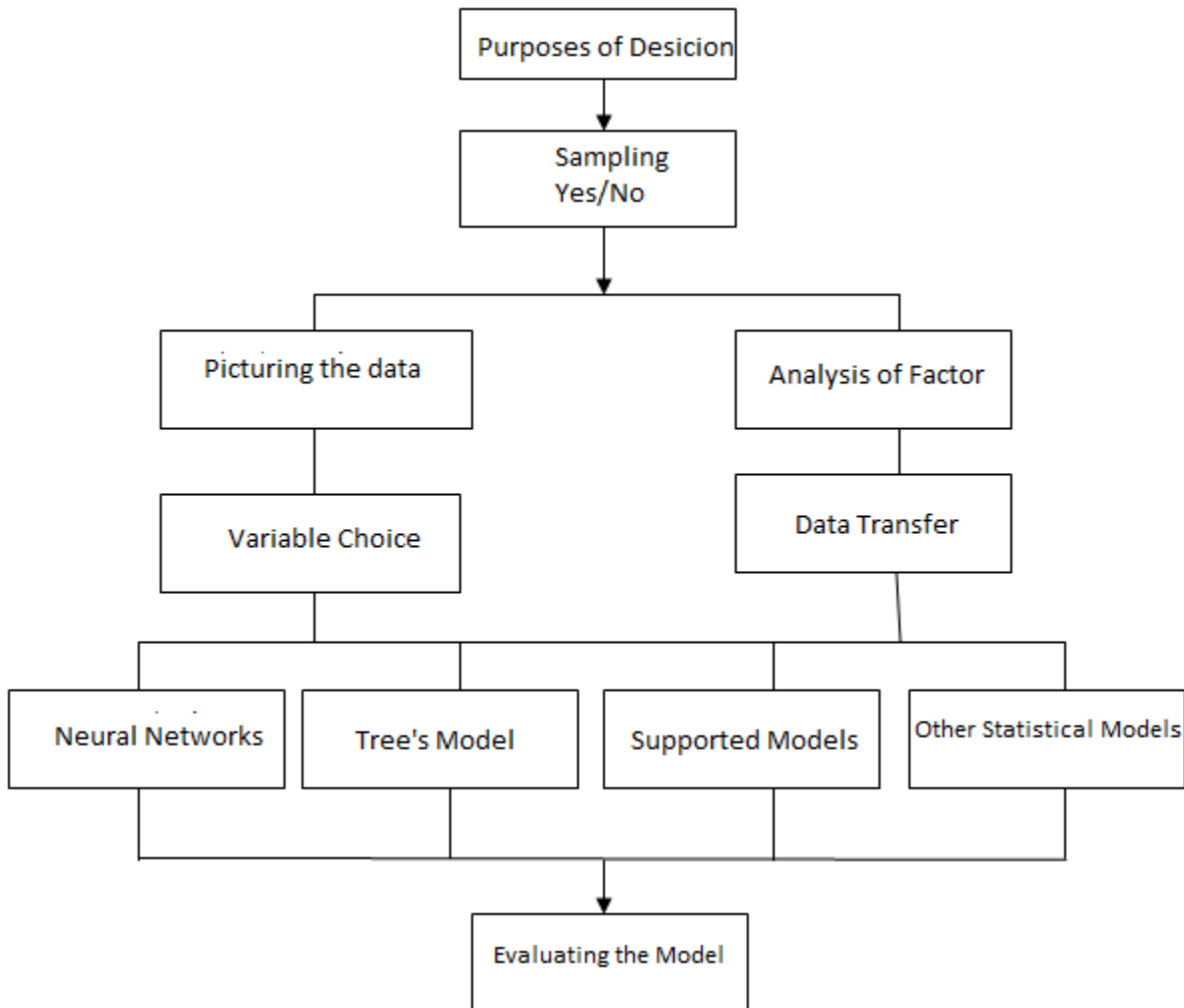
Iterative learning process continues until the model is acceptable. While the knowledge discovery frameworks are focused on the aim of discovery, a data mining model which helps to infer patterns are also equally important. A systematic approach to maintain, improve, revise and use the data model (as shown in frameworks) is crucial for effective decision making in the future.(7)

The process of selecting knowledge discovery and data mining techniques on a set of data acts unstructured and based on judgments. For example, from the customer data(point of sale), the marketer may begin to identify purchase patterns in different parts. Then the characteristics of these components will be assigned to the purchase patterns(for each section). Important differences of sale patterns in one section and similarities in sale pattern between more other sections may lead to improve this section. In doing so, marketers can explore the interesting sections with statistical characteristics. In an age when customer's demands are rapidly changing, the proper function of data mining helps marketers to apply rapidly these interesting parts.

Issues in Knowledge Management

One of the most important issues in knowledge management organization is distributed and development of the knowledge. The knowledge can be created by using data mining tools or can be obtained from a third person, although it can also be revised. The knowledge collection can also be organized with indexing knowledge factors, filtering by content, relationship and bonds between these factors.(4) Therefore we complete this knowledge in a database(knowledge base) and also publish it in applied support programs of decision. The insights gained by application of decision are created for revising and improving the knowledge and are used in the organization of

knowledge. We have shown this distributed and improved form in Figure 3 such as a process. Increase the impact of knowledge management process requires accurate definition of knowledge factors, however a marketing knowledge could be distributed so wide and shared on total applications programs and also can be sent to the internet decision makers.

Figure 3. Developing, distributing and organizing of knowledge
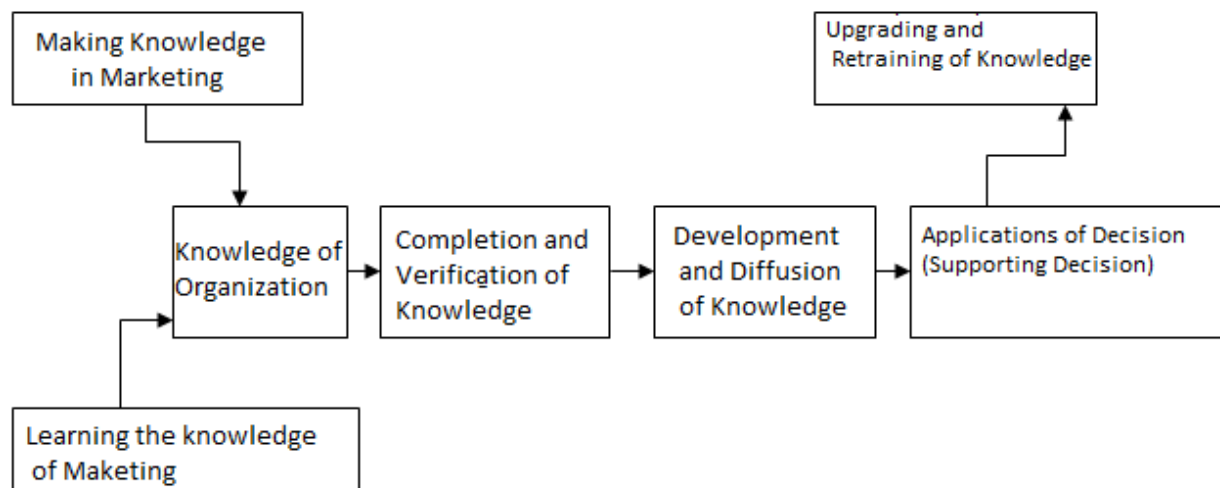
The second important issue in knowledge management is to complete knowledge in dispersed sources. The knowledge of marketing decision-making can be achieved through three main sources. Customer knowledge of retailer, consumer knowledge of marketing research and market knowledge from data supply by third person.

Figure 4, increasingly this knowledge is shared by the commercial institute with its supply chain models (such as suppliers and retailers). Information and internet technology improve the knowledge sharing. One of the classic examples of this co-operation, is the partnerships between P&G(Procter & Gamble) and Wal-Mart. Business Team of Wal-Mart / P & G use from the broad concepts like Data General, Scorecard collaborative, client control table to share knowledge for mutual benefit to the parties to make further progress. Wal-Mart developed a tool that allowed sharing the data by carriers' manufacturer partners and vendors. P&G transfer some storage systems to other clients.(15) When an institution of global trade develop the supply chain, the marketing knowledge will cross from organizational boundaries. In such scenario, ownership and access to marketing knowledge, standards of exchanging knowledge and sharing of spatial applications have become critical success factors. Moving from mass marketing into relationship marketing with customer, needs some decision makers to the specific strategies that are taken for each individual(based on history and situation). With traditional tools, determining and searching this classified market are so complex. In today's complex environment and changing customer preferences, marketing decisions that are taken through knowledge about customers are essential. For example, catalog retailers like Land's End, LL Bean use the customer purchasing patterns to calculate the probability of purchase for any merchandise. Armed with this information, these companies send the catalogs that buying probability and calculating it exceed the threshold value for the customers. Data mining tools put a kind of knowledge to marketers that makes the marketing decisions correct. Accurate knowledge of the customer, combined with a day of interactive technology. For example in web, this leads to successful relationship marketing and management according to its progress. But for centered marketing strategy on customer knowledge discovery must be managed systematically. We call the completing process and implementation of marketing decisions with customer knowledge, marketing. In the following section, we discuss how marketers can benefit from knowledge-based marketing.(6)

Knowledge-Based Marketing

Marketing decisions, such as the wide channels, promotions, advertisements and media based on a traditional segmentation methods lead to poor response and increase the costs. Modern customers are so diverse and have so varied preferences that grouping them into homogeneous categories for developing marketing strategies is not possible. In fact, each customer wants to service based on its specific needs. The marketing database that describes by marketing strategies based on extensive information gathered from customer database and transaction database has become increasingly and many organizations have formed a giant database about purchase transactions and customers.(14) But because of the lack of tools and appropriate techniques to analyze massive databases, health information and customer purchasing patterns are hidden and are useless in these databases. Knowledge-based assessment, which is using proper data mining tools and

knowledge management framework, address this need and help to apply hidden information in databases.(12) There are three main areas of application about applying data mining based on knowledge. 1- Description of the circumstances of the customer, 2- Deviation analysis and 3- Behavior analysis and trends.

Description of the Client (Assessment)

One of the values and knowledge sources of the client is his condition and assessment which is used to make market decisions. The client history and his assessment is a model of customer which based on that the marketer makes decision about correct strategies and clever scheme of estimate customer needs.

The Frequency of Purchases

To what extent does the customer buy your product or visit your shop? By obtaining knowledge of this case, the marketers can do target advertising such as "frequent purchase programs".(17)

Purchases

How much time does a customer spend on transactions? This information helps the marketer to give the Persian sources to the customer which constituted more time for himself.

Figure 4. Integrated knowledge management system for marketing
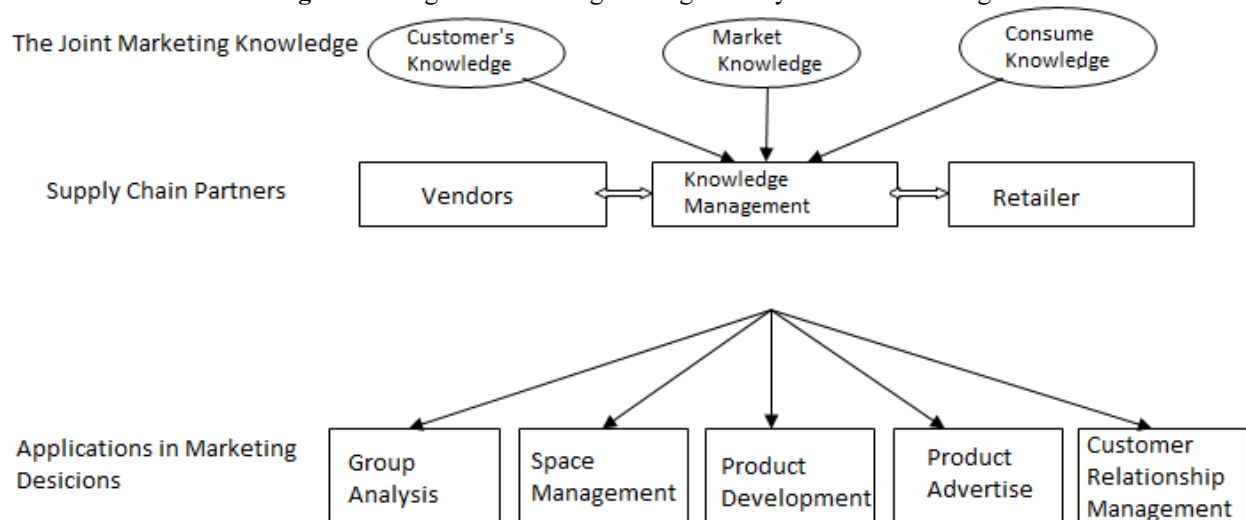
Novelty of Purchases

How long is that the customer did his last purchase and is not referred here? The marketer may study the reasons of the customer or group about not doing purchases in an extended period and go through appropriate steps. The reason may be that the customer has been changed his location or his choice.(13)

Determine and Identify a Group of Customers

The specifications of each group can be achieved by describing the concept determining the class. For example, a biography shows that the customer, who bought a new house, must be serviced by marketers for representing home cares. Understanding the customer and focusing on transaction is created a better answer than the overall message.

Estimate the Value of Customers

By understanding the customer's history in assistance of knowledge discovery system, a number of marketing activities are increased, such as calculating values of customer's life, or customer access and success or failure of marketing programs. Customer's values are a measure to understand what is happening to the core values of customer. However by using the customer history, customer data and developed statistics of product are calculated. Long-term values of customer (lifetime) are some scales that can help to marketers for making judgments about their charges (by evaluating the efficiency of the plan to generate assets).(18)

Customer Access

Customer history and his status, specially their purchasing patterns, give some sings to the marketers. For example, consider the pattern of buying toys for age group of 3-5, that purchasing bikes for boys is about 99% in 6 months and bought by customers with higher income are discovered by data mining.(16) The marketers which has high

knowledge and information about the above pattern, could attracts the future customers for bicycle of boy based on purchases details and sent the brochure for customers. Therefore his sales have been increased.

Failure or Success of Marketing Programs
Databases provide accurate information from the marketing programs. Marketers can use the purchase's patterns of database and marketing programs to evaluate long-term and short-term of this programs.(19)

Analysis of Fraud
Knowledge and understanding of fraud in the normal state is so important for the marketer. A fraud can be unusual and like an abuse or a change. In the past, detecting such deviation was difficult, but data mining tools provide the appropriate solutions such as neural networks for detection and classification of such deviations. For example, purchasing by credit too much can be considered as a fraud and an abuse or it could be a modified valid purchasing by customer.(22)
When cheating is identified as a fraud, the marketer spends steps to prevent such actions and deception. If fraud is detected as a change, more information is needed. For example, a change can be a new job of customer or going to a new home. In this case, the marketer needs to update its knowledge of the customer. Marketer can use to change the look of the ability to detect deviations as a result of recent price change, or progress has occurred.

Analysis and Evaluation Process (Pattern of Behavior)
The pattern of behavior is patterns that are emphasized in a period of time. The trend of behavior pattern can have short time trend (such as an immediate increase and decrease of the sales in a planned manner for sale) or the process can be lengthy, such as low flattering on sale in a few years. Data mining tools, such as visualizations, help us to discover patterns of behavior that sometimes they are hidden in accurate database and have been lost by the analysis tools. In marketing decisions, behavior patterns can be used to evaluate marketing plans or forecasts of future sales. (20)

Evaluation of the Performance of the Products or Affiliate Programs
Customer database has a detailed record of transactions and deals. Marketer can use visualization tools to detect and identify trends and patterns of behavior and video sales , costs and profits and product sales territories or markets used to understand the development impact . It also provides statistical data mining tools to accurately evaluate the performance of different parameters of interest.

Forecast Future Sales
One usage of a comprehensive behavioral patterns and trends is to forecast future sales. Marketers are interested to understand how various marketing plans for future sales affect their products. Data mining can help to discover accurate relations. Generally, there are four main steps for customer relationship management which include: (1) define and identify customers, (2) to distinguish them from each other (3) interaction with customers and learning from existing customers, and (4) to customize the product (using constructively) or individual service and attention to customer needs, based on a better understanding of the clients. Recent efforts in customer relationship management, customer relationship management have focused on customer interaction. (23) However, insufficient knowledge about customers and lack a systematic framework for managing knowledge prevent effort of organizations. Especially in the marketing function for customer relationship management, the knowledge of management framework discussed in this paper, can provide the basis for enterprises to effectively identify customer knowledge discovery and connection management strategy is completed. (27)

Challenges in Knowledge of Management Research in Marketing
Knowledge of management and data mining is still an evolving field, and therefore the implications for marketing, the interesting challenges for researchers and planners offer. When we present additional framework for managing knowledge in the field of marketing, we recognize that there are significant research challenges that must be addressed. (25)
Some of them is related to the data mining techniques and some knowledge about the detection process, while others are related to knowledge of management. The knowledge discovery via data mining, an interactive learning process (similar to the processes of knowledge creation) is like scientific discovery and identification. Select a data mining algorithms forming hypotheses evaluation of revised model, the main characteristics of the process are identified and explored. One of the challenges of research is make structure of the development process and thus the efficiency of data mining efforts. (24)

The second challenge is knowledge of management and organizational boundaries passes will be distributed among the participants of the supply chain. Research topics are important to develop accurate models of knowledge of management within an enterprise (inter-enterprise), the rights of children and the distribution of profits among their partners. (26),

The third challenge for research on knowledge of management is multiple categories. In this situation, customers can not belong to more than one group. Recent data mining techniques in the management of multiple classes of users have been limited. Increasing complexity of customer preferences marketers have realized it, they are faced with customers who have several membership categories require a valid tool. Marketer may want to subscribe to multiple (different members) used to gain important knowledge about customers.

Of course, this is still another important challenge "web search" is that with the advent of the Internet as a new channel of distribution, product development, management of transactions and trades and the coordination of business processes, the Web as a source of important customer data (source of information from customers) has stepped into the realm of appearance. But multiple data formats and extensive knowledge of web, gathering, detecting, identifying, organizing and managing knowledge to support decisions, marketing has become a challenge. As more and more Web-based marketing (for the client), web search, and knowledge management must address the issue of marketing. (28),

RESULTS AND DISCUSSION

Although data mining techniques in several areas such as discovery, abuse, bankruptcy prediction, medical diagnosis and the discovery of the employed are used to support the decision, interesting and unique marketing, such as customer relationship management, marketing immediate interactive, customer history, and knowledge management is emphasized.

In the recent customer-driven business environment, we believe the company is needed to provide a deeper understanding of data mining and knowledge of management and marketing decisions. In this paper we show how data mining can be implemented in the framework of knowledge of management in marketing. Despite the great volume of data, the basic problems are filtering, sorting, processing, analysis and managing the data in order to obtain information for users. Systematic application of data mining techniques will increase knowledge of management process and it helps the marketers to provide for customers better service and better information and knowledge they acquire.

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